Jiyeon Kang | Curriculum Vitae

Personal Details

Assistant Professor
Department of Mechanical and Aerospace Engineering
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Principal Fields of Interest

- **Cable-actuated Rehabilitation Robot**
  Force/torque intervention on the pelvis to improve abnormalities of motor function. Correction of gait deficit by assist-as-needed training control paradigm.
- **Prosthesis Design and Control**
  Prosthetic device that is lightweight and robust in harsh environments including liquid contamination. Control methods for the multi-dof prosthesis using upper arm motions and sEMG signals.
- **Mobility of Cerebral Palsy Children**
  Providing intervention with different strategies in order to improve gait deficit of cerebral palsy children: direct force intervention at the center of mass or training to drive a mobile robot for enhancing motor planning.

Academic Qualifications

- **Ph.D., Mechanical Engineering** Feb. 2018
  Columbia University, United States of America
  Supervisor: Prof. Sunil K. Agrawal
  Thesis: Robotic functional gait rehabilitation with tethered pelvic assist device
- **M.S., Mechanical & Aerospace Engineering** Aug. 2010
  Seoul National Univeristy, South Korea
  Supervisor: Prof. Frank C. Park
  Thesis: Minimum heat loss control of fluid-powered system
- **B.S., Mechanical & Aerospace Engineering** Aug. 2008
  Seoul National University, South Korea

Professional Experience

- **Assistant Professor**
  University at Buffalo, The State University of New York — *Jan. 2019 – Present*
- **Postdoctoral Research Fellow**
  University of Michigan — *Jan. 2018 – Nov. 2018*
- **Researcher**
  Korea Institute of Science and Technology — *Jan. 2011 – Jul. 2012*

Publications

Contribution as corresponding author denoted by *. Blue text color indicates UB affiliation. Green (red) text color indicates graduate (undergraduate) students from UB.
Google scholar citations: 93, h-index 6, i10-index 5.

1. S. R. Lamooki, J. Kang, L. A. Cavuoto, F. M. Megahed, and L. A. Jones-Farmer, "Gait Monitoring Using Multivariate Control Chart," under preparation
2. D. Martelli, **J. Kang**, F. Aprigliano, U. Staudinger, and S. K. Agrawal, "Single-session perturbation-based balance training improves gait stability and cognitive performance in healthy older adults," submitted.
3. V. Santamaria, M. Khan, T. Luna, J. Kang, J. Dutkowsky, A. Gordon, S. Agrawal, " Sitting Aquisition in Cerebral Palsy Using the Robotic Trunk-Support-Trainer," submitted.
4. J. Kang*, M. A. Gonzalez, B. R. Gillespie, and D. H. Gates, "A haptic object to quantify the effect of feedback modality on prosthetic grasping," *IEEE Robot. Autom. Lett.* 4 (2019) 1101–1108. [Link]
5. J. Kang, K. Ghonasgi, C. J. Walsh and S. K. Agrawal, "Simulating hemiparetic gait in healthy subjects using TPAD with a closed-loop controller," *IEEE Trans. Neural Syst. Rehabil. Eng.* 27 (2019) 974–983. [Link]
6. K. Ghonasgi, J. Kang, and S. K. Agrawal, "Walking with a weighted pelvic belt or with an equivalent pure downward force on the pelvis: are these different?," *IEEE Robot. Autom. Lett.* 4 (2019) 309–314. [Link]
7. F. Aprigliano, D. Martelli, **J. Kang**, S.-H. Kuo, U. J. Kang, V. Monaco, S. Micera, and S. K. Agrawal, "Effects of repeated waist-pull perturbations on gait stability in subjects with cerebellar ataxia," *J. Neuroeng. Rehabil.* 16 (2019). [Link]
8. **J. Kang** and S. K. Agrawal, Chapter 9. Robot enhanced walkers for training of children with cerebral palsy: pilot studies. In *Encyclopedia of rehabilitation robotics* (World Scientific, Singapore, 2018), 217–240. [Link]
9. **J. Kang**, D. Martelli, V. Vashista, I. Martinez-Hernandez, H. Kim, and S. K. Agrawal, "Robot-driven downward pelvic pull to improve crouch gait in children with cerebral palsy," *Science Robotics* 2 (2017) eaan2634. [Link] [MovieLink1] [MovieLink2] [MovieLink3]
10. **J. Kang**, V. Vashista, and S. K. Agrawal, "On the adaptation of pelvic motion by applying 3-dimensional guidance forces using TPAD," *IEEE Trans. Neural Syst. Rehabil. Eng.* 25 (2017) 1558–1567. [Link]

11. D. Martelli, L. Luo, **J. Kang**, U. J. Kang, S. Fahn, and S. K. Agrawal, "Adaptation of stability during perturbed walking in Parkinson's disease," *Sci. Rep.* 7 (2017) 17875. [Link]
12. M. Khan, V. Santamaria, **J. Kang**, B. Bradley, J. Dutkowsky, A. M. Gordon, and S. K. Agrawal, "Enhancing seated stability using trunk support trainer (TruST)," *IEEE Robot. Autom. Lett.* 2 (2017) 1609–1616. [Link]
13. S. K. Agrawal, **J. Kang**, X. Chen, M. J. Kim, Y. Lee, S. W. Kong, H. Cho, and G.-J. Park, "Robot-enhanced mobility training of children with cerebral palsy: short-term and long-term pilot studies," *IEEE Syst. J.* 10 (2016) 1098–1106. [Link]

Peer-reviewed Conference Papers

1. S. R. Lamooki, J. Kang, L. A. Cavuoto, F. M. Megahed, and L. A. Jones-Farmer, "Challenges and Opportunities for Online Monitoring of Gait Profiles Observed from IMU Data for Fatigue Detection," in *IEEE Ras & Embs International Conference on Biomedical Robotics and Biomechatronics*, 2020 (Submitted).
2. P. He, B. Xu, J. Kang*, "Spherical Parallel Instrument for Daily Living Emulation (SPINDLE) to Restore Motor Function of Stroke Survivors," in *IEEE Ras & Embs International Conference on Biomedical Robotics and Biomechatronics*, 2020 (Submitted).
3. M. A. Gonzalez, J. Kang, C. Lee, B. Gillespie, D. Gates, "The impact of prosthesis type on sensory perception and grasping performance," in *International Society of Biomechanics/American Society of Biomechanics (ISB/ASB) Congress* , 2019.
4. C. Lee, M. Gonzalez, J. Kang, D. Gates, "The impact of prosthesis type on sensory perception and grasping performance," in *International Society of Biomechanics/American Society of Biomechanics (ISB/ASB) Congress*, 2019.
5. D. Martelli, **J. Kang**, and S. K. Agrawal, "A perturbation-based gait training with multidirectional waist-pulls generalizes to split-belt treadmill slips," in *IEEE Ras & Embs International Conference on Biomedical Robotics and Biomechatronics* (*BioRoB*), 2018, pp. 7–12. [Link]
6. K. Ghonasgi, **J. Kang**, and S. K. Agrawal, "Walking with a weighted pelvic belt or with an equivalent pure downward force on the pelvis: are these different?," in *IEEE Ras & Embs International Conference on Biomedical Robotics and Biomechatronics* (*BioRoB*), 2018, pp. 318–323. [Link]
7. E. Park, **J. Kang**, H. Su, P. Stegall, D. Miranda, W.-H. Hsu, M. Karabas, N. Phipps, S. K. Agrawal, E. Goldfield, and C. J. Walsh, "Design and preliminary evaluation of a multi-robotic system with pelvic and hip assistance for pediatric gait rehabilitation," in *IEEE-RAS-EMBS International Conference on Rehabilitation Robotics* (*ICoRR*), 2017, pp. 332–339. [Link]
8. D. Martelli, **J. Kang**, and S. K. Agrawal, "A single session of perturbation-based gait training with the A-TPAD improves dynamic stability in healthy young subjects," in *IEEE-RAS-EMBS International Conference on Rehabilitation Robotics* (*ICoRR*), 2017, pp. 479–484. [Link]
9. **J. Kang**, V. Vashista, and S. K. Agrawal, "A novel assist-as-needed control method to guide pelvic trajectory for gait rehabilitation," in *IEEE International Conference on Rehabilitation Robotics* (*ICoRR*), 2015, pp. 630–635. [Link]
10. N. Jin, **J. Kang**, and S. K. Agrawal, "Design of a Novel Assist Interface where Toddlers Walk with a

Mobile Robot Supported at the Waist," in *IEEE International Conference on Rehabilitation Robotics* (*ICoRR*), 2015, pp. 577–582. [Link]

11. **J. Kang**, S. Logan, J. C. Galloway, and S. K. Agrawal, "A chase-game to teach children on a robot to follow moving objects," in *IEEE International Conference on Robotics and Automation* (*ICRA*), 2014, pp. 234–239. [Link]
12. S. K. Agrawal, **J. Kang**, X. Chen, M. Kim, Y. Lee, S. Kong, and G. Park, "Case studies of a robot enhanced walker for training of children with cerebral palsy," in *IEEE/RSJ International Conference on Intelligent Robots and Systems* (*IRoS*), 2013, pp. 4243–4248. [Link]
13. **J. Kang**, K. Kim, S. J. Kim, and S. R. Oh, "On the comfortableness of muscle power assistive robotic system," in *IEEE Ras & Embs International Conference on Biomedical Robotics and Biomechatronics* (*BioRoB*), 2012, pp. 1759–1764. [Link]
14. **J. Kang** and F. C. Park, "Minimum heat loss control of fluid-powered systems," in *International Conference on Control, Automation and Systems* (*ICCAS*), 2011, pp. 1383–1387. [Link]

Patents

1. S. K. Agrawal, V. Vashista, **J. Kang**, X. Jin, Human movement research, therapeutic, and diagnostic devices, methods, and systems, US10,406,059 B2 (Granted on 2019-09-10) & EP15783400.3A (Granted on 2019-07-03) & PCT/US2015/026941 (Publicated on 2017-10-29). [Link]

Service

- Panel, University at Buffalo Female Engineering TINKER Camp for High School Girls (2019)
- Ph.D. Qualifier Exam Committee (2019)
- M.S. Oral Comprehensive Exam Committee (2019)

Grant

- Korean scientists and engineers association YIG (Young Investigator Grant), "A cable-actuated Interactive Prosthetic Arm for Daylily Living (I-PADL) of transradial amputees ", Total Award: $11,000. Duration: 09/20-08/23. Role: PI, Share 100 %(reject)
- Buffalo Blue Sky, "A11 dopaminergic mediation in brain aging disease", Machiko Tomita, Jinwoo Park, Jiyeon Kang (2019)
- NSF, Disability and Rehabilitation Engineering, Title: Identification Of Effects Of Different Prosthetic Design Factors Using Interpretable Machine Learning. Total Award: $399,868. Duration: 09/20-08/23. Role: PI, Share 65 %, Co-PI: Deanna Gates (Pending).
- DoD, Restoring Warfighters with Neuromusculoskeletal Injuries Research Award, Title: An Intelligent Prosthesis for Active Daily Living (I-PADL). Total Award: $499,980. Duration: 09/20-08/23. Role: PI , Share 65 %, Co-PI: Deanna Gates (Pending).
- SUNY Research Seed Grant Program, Title: Novel Gait Training Paradigm to Promote Healthy Aging in Individuals with Cerebral Palsy. Total Award: $40,000. Duration: 09/20-02/22. Role: PI , Share 30 %, Co-PI: Jeanne Langan, Wenyao Xu, Jihnhee Yu (Pending).

Honors and Awards

- Korea Presidential Science Scholarship (2004)
- Korea National Graduate Science & Technology Scholarship (2008)

Teaching Experience

- **Biomechanics of the Musculoskeletal System**
  University at Buffalo, Dept. of Mechanical & Aerospace Engineering *Spring 2019*
  Instructor (Enrolled: 28/30)
- **Mechatronics**
  University at Buffalo, Dept. of Mechanical & Aerospace Engineering *Fall 2019*
  Instructor (Enrolled: 37/30)

Invited Presentations

1. Departmental Seminar, Mechanical engineering, KAIST (Korea Advanced Institute of Science and Technology), "Functional Mobility Rehabilitation with a Cable-actuated Pelvic Assist Robot," January 9, 2020.
2. Departmental Seminar, Mechanical engineering, Seoul National University, "Functional Mobility Rehabilitation with a Cable-actuated Pelvic Assist Robot," January 8, 2020.
3. Departmental Seminar, Rehabilitation science department, University at Buffalo, The State University of New York, "Functional Mobility Rehabilitation with Assist Robot for Children with Special Needs," October 11, 2019.
4. University at Buffalo Neurology Grand Rounds, "Emerging Technologies in Rehabilitation," September 19, 2019.
5. University at Buffalo Female Engineering TINKER Camp for high school girls, "My Life in Mechanical and Aerospace Engineering," Representative Speaker, August 6, 2019 .
6. Work-in-progress Seminar, Department of Rehabilitation Science, State University of New York at Buffalo,"Cable-actuated robotic gait training: strength VS coordination," Jan 25, 2019.
7. Departmental Seminar, Mechanical and aerospace engineering department, University at Buffalo, The State University of New York, "Functional gait rehabilitation with pelvic assist robot for children with special needs," February 15, 2018.
8. Cerebral Palsy Research Retreat, Columbia pediatric orthopedics department, Columbia University Medical Center, "Tethered pelvic assist device to improve gait of children with cerebral palsy," June 30, 2017.

Research Mentoring

Ph.D. Student - Current
- Saeb Ragani Lamooki (co-advising with Dr. Lora Cavuoto)

M.S. Student - Current
- Rishi Adusumilli (expected Spring 2020 graduation)

Thesis title: Physiological change in using MyoBox of the body-powered prosthesis
- Nikhil Tej Kantu (expected Fall 2021 graduation)
Thesis: Novel control strategy of a haptic knob to promote rehabiliation of stroke survivors
- Nicholas Lenhard (expected Spring 2020 agraduation)
Project title: Understanding Movement Synergy during Active Daily Living with an Interpretable Machine Learning

M.S. Student - **Past** - Peidong He (Fall 2019 graduation)
Thesis title: Design of 3-RRR parallel mechanism for a rehabilitation device

Undergraduate student - **Current** Jordan Brathwaite(BME), Boxin Xu(MAE), Ibrahim Soliman(MAE), Osama Alomari(MAE), Patrick Mose(MAE), Jack Dondero(MAE), Alex Iofe(MAE)

Undergraduate student - **Past** Zach Struczewski (BME), Anoop Kiran (MAE), Robert Syarbaini (MAE), David Cummiskey (MAE, Zimmer Awardee)

Member of Ph.D. Thesis/Project Committees
- Ph.D. Committee member of: Qian Zhang (ISE), Nikta Amiri(MAE)
- Thesis/Project Committee member of: Young Jin Kim (MAE)

Professional Activities

Conference Service
- Organizing Committee, Workshop Chair, IEEE Ras & Embs International Conference on Biomedical Robotics and Biomechatronics (*BioRoB*), 2020
- Workshop Proposal Reviewer, IEEE International Conference on Robotics and Automation (*ICRA*), 2018
- Session Chair, International Conference on Ubiquitous Robots, 2018

Reviewer
- ASME Journal of Mechanisms and Robotics
- IEEE/ASME Transactions on Mechatronics
- IEEE Robotics and Automation Letters
- MDPI Sensors
- Journal of Motor Behavior
- IEEE International Conference on Robotics and Automation
- IEEE International Workshop on Intelligent Robots and Systems
- IEEE International Conference on Biomedical Robotics and Biomechatronics
- IEEE International Conference on Rehabilitation Robotics
- ASME International Design Engineering Technical Conferences

Press

Robot-driven downward pelvic pull to improve crouch gait in children with cerebral palsy
1. Researchers have made a breakthrough to help kids with cerebral palsy walk better, Quarz, July,

2017. [Link] [Movie]
2. Robotic device may help gait in kids with cerebral palsy, EurekAlert!, July, 2017. [Link]
3. Next-generation exoskeletons help patients move, The Scientist, February, 2018. [Link]
4. Wearable robotics assisting stroke, cerebral palsy patients, what's new in Electronics, July, 2017. [Link]
5. Robohub Digest 07/17, Robohub, August, 2017. [Link]
6. Robotic device may help gait in kids with cerebral palsy, U.S. News, July, 2017. [Link]
7. Treadmill robot helps fight cerebral palsy symptoms in children, IMechE, July, 2017. [Link]
8. Gehhilfen, die man anziehen kann, Science.ORF.at, July, 2017. [Link]

Adaptation of stability during perturbed walking in Parkinson's disease

1. Robotic device improves balance and gait in Parkinson's disease patients, EurekAlert!, December, 2017. [Link]
2. Robotic device developed by Columbia University 'improves balance and gait' in Parkinson's disease patients, Robotics and Automation News, December, 2017. [Link]